

AMENDMENTS TO THE CLAIMS:

This listing of claims replaces all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A method of operating an electrochemical fuel cell having an anode, an ion transfer membrane, and a cathode, comprising ~~the steps of~~:

delivering fluid fuel to fluid flow channels within the anode;

delivering fluid oxidant to fluid flow channels within the cathode;

exhausting reaction by-products and ~~any~~ unused oxidant from the fluid flow channels within the cathode; and

delivering a sufficient quantity of liquid water to the fluid flow channels within the cathode such that a relative humidity of 100% is maintained substantially throughout the fluid flow channels.

2. (Currently Amended) The method of claim 1, ~~in which the step of~~ wherein delivering a sufficient quantity of liquid water comprises:

determining a maximum in fuel cell voltage as a function of liquid water flow rate; and

delivering at least a minimum water flow rate corresponding to said the maximum fuel cell voltage maximum.

3. (Currently Amended) The method of claim 1, which is performed on applied to a
plurality of such cells electrochemical fuel cells in a fuel cell stack;[[],] in which the step of
wherein delivering a sufficient quantity of liquid water comprises:

determining a maximum ~~in~~ stack voltage as a function of liquid water flow rate;

and

delivering at least a minimum water flow rate corresponding to ~~said~~ the maximum
stack voltage maximum.

4. (Currently Amended) The method of claim 1, ~~claim 2 or claim 3~~ further comprising:
including the step of increasing the quantity of liquid water delivered as a function of fuel
cell or stack current to maintain a water factor $WF > 1.0$ for all currents within a normal
operating range of the fuel cell or stack.

5. (Currently Amended) The method of claim 2, wherein in which the step of delivering
a sufficient quantity of liquid water comprises:

determining a maximum ~~in~~ cell voltage as a function of liquid water flow rate for each of
a plurality of fuel cell currents that correspond to a normal range of operating conditions of the
fuel cell;[[],]

determining a calibration function expressing a minimum liquid water flow rate as a
function of current and/or air stoichiometry; and

delivering at least said the minimum liquid water flow rate, for the current drawn from said the fuel cell and/or for the air stoichiometry, as determined by the calibration function.

6. (Currently Amended) The method of claim 3, wherein in which the step of delivering a sufficient quantity of liquid water comprises :

 determining a maximum in stack voltage as a function of liquid water flow rate for each of a plurality of stack currents that correspond to a normal range of operating conditions of the stack;[[,]]

 determining a calibration function expressing a minimum liquid water flow rate as a function of current and/or air stoichiometry; and

 delivering at least said the minimum liquid water flow rate, for the current drawn from said the stack and/or for the air stoichiometry, as determined by the calibration function.

7. (Currently Amended) The method of claim 5, wherein or claim 6 in which the calibration function is determined for air stoichiometry in the a range 1.1 to 10.

8. (Currently Amended) The method of claim 7, wherein in which the calibration function is determined for air stoichiometry in the a range 1.4 to 4.0.

9. (Currently Amended) The method of ~~any preceding claim 1, wherein in which the~~ step of delivering a sufficient quantity of liquid water comprises delivery of a water factor of at least 1.5.

10. (Currently Amended) The method of claim 9, ~~wherein in which the~~ step of delivering a sufficient quantity of liquid water comprises delivery of a water factor of at least 3.

11. (Currently Amended) The method of claim 9, ~~wherein or claim 10 in which the~~ step of delivering a sufficient quantity of liquid water comprises delivery of a water factor of less than 40.

12. (Currently Amended) The method of claim 11, ~~wherein in which the~~ step of delivering a sufficient quantity of liquid water comprises delivery of a water factor in the range from 3 to 6.

13. (Currently Amended) The method of ~~any preceding claim 1 further including the~~ step of comprising:

temporarily permitting delivery of a quantity of liquid water to the fluid flow channels within the cathode such that a relative humidity of less than 100% is maintained when the cathode an exhaust temperature of the cathode is below a predetermined threshold corresponding to a sub-optimal operating temperature.

14. (Currently Amended) The method of claim 13, which is applied upon start-up of the fuel cell or fuel cell stack.

15. (Currently Amended) The method of claim 1, wherein in which the fuel cell is operated such that, for any measured fuel cell power delivery, a liquid water injection rate into the cathode and/or gas flow through the cathode are controlled to ensure that there is more liquid water at in all regions of the a cathode surface than can be evaporated in the prevailing temperature and pressure conditions.

16. (Currently Amended) The method of claim 15, which is performed on applied to a plurality of such electrochemical fuel cells in a fuel cell stack having a common oxidant supply manifold and a common water injection manifold such that, for any measured stack power delivery, liquid water injection rate into the water injection manifold and/or gas flow rate in the oxidant supply manifold are controlled to ensure that there is more liquid water at in all regions of the cathode surfaces of all of the fuel cells than can be evaporated in the prevailing temperature and pressure conditions.

17. (Currently Amended) An electrochemical fuel cell assembly comprising:
at least one anode fluid flow field plate having fluid flow channels therein;
at least one ion transfer membrane;

at least one cathode fluid flow field plate having fluid flow channels therein;
~~means a mechanism for delivering fluid fuel to the anode fluid flow channels;~~
~~means a mechanism for delivering fluid oxidant to the cathode fluid flow channels; and~~
a water injection mechanism for delivering a sufficient quantity of liquid water to the fluid flow channels within the cathode such that a relative humidity of 100% is maintained substantially throughout the fluid flow channels during normal operating conditions of the fuel cell.

18. (Currently Amended) The assembly of claim 17, ~~wherein in which~~ the water injection mechanism comprises a pump and a controller.

19. (Currently Amended) The assembly of claim 18, ~~wherein in which~~ the controller ~~includes~~ comprises a voltage sensor for sensing a fuel cell or ~~fuel cell stack~~ voltage.

20. (Currently Amended) The assembly of claim 19, ~~wherein in which~~ the controller is ~~adapted~~ configured to operate in a calibration mode comprising determining a maximum ~~in~~ cell voltage as a function of liquid water flow rate for each of a plurality of normal fuel cell or fuel cell stack operating currents.

21. (Currently Amended) The assembly of claim 20, wherein in which the calibration mode further comprises determining a calibration function expressing a minimum liquid water flow rate as a function of current and air stoichiometry.

22. (Currently Amended) The assembly of claim 18, further including comprising: a current sensor for sensing current flow through the fuel cell or through a fuel cell stack;[[,]] and in which wherein the controller is adapted configured to control a water injection rate to maintain delivery of a water factor $WF > 1.0$ for all fuel cell or fuel cell stack currents within a normal operating range.

23. (Currently Amended) The assembly of claim 22, wherein in which the controller is adapted configured to control the water injection rate to maintain delivery of a water factor of at least 1.5.

24. (Currently Amended) The assembly of claim 23, wherein in which the controller is adapted configured to control the water injection rate to maintain delivery of a water factor of less than 40.

25. (Currently Amended) The assembly of claim 24, wherein in which the controller is adapted configured to control the water injection rate to maintain delivery of a water factor of at least 3.

26. (Currently Amended) The assembly of claim 18, wherein in which the controller is adapted configured to control the water injection rate to maintain of delivery of a water factor in a the range from 3 to 6.

27. (Currently Amended) The assembly of ~~any one of claims 17 to 26~~ claim 17, further including comprising:

a mechanism means for temporarily permitting delivery of a quantity of liquid water to the fluid flow channels within the cathode such that a relative humidity of less than 100% is maintained when the a cathode exhaust temperature is below a predetermined threshold corresponding to a sub-optimal operating temperature.

28 and 29. (Cancelled)